INSTRUCTION MANUAL

MODELS

RD-105M

RELAY OPERATED PROGRAMMABLE DECADE RESISTANCE

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IM110/RD-105M REV 10/84

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SECTION 1

GENERAL INFORMATION

1-1 INTRODUCTION

This manual contains operation instruction for the Model RD-105M Relay Operated Decade Resistance.

1-2 CHANGE RECOMMENDATIONS

Recommendations proposing changes to this manual shall be submitted to Julie Research Laboratories, Inc., 211 West 61st Street, New York, N.Y. 10023.

1-3 DESCRIPTION

The Model RD-105M is an accurate and versatile programmable resistance. Five high performance, high speed resistor switching modules allow any resistance from 1 ohm to 100,000 ohms to be synthesized.

Operation of the RD-105M may be manual, automatic, or remote-manual with no degradation of performance.

1-4 COMPLIMENTARY EQUIPMENT

The following equipment, which compliments the RD-105M, is available for use.

a. Model ACS-106 Automated Current Source fully programmable with automated polarity and ranging options and compatible with other Julie automated equipment.

b. Model AVS-106 Automated Voltage Source also fully compatible, and also with automated polarity and ranging.

c. Model ACV-106 Programmable Voltage and Current Source.

d. Models MS-106 and SM-2100 Programmable Scanners for selecting 10 two terminal points or 100 two-terminal points.

f. Model ND-106 Null Detector for precision null indication.

g. Model PRS-106 Programmable Resistance Standard.

TABLE I-I

SPECIFICATIONS

DECADE/RANGE	OHMS/STEP	ACCURACY	CURRENT RATING
100K	10K	±0.01%	1.5MA
10K	1K	±0.01%	5MA
1K	100	±0.1ohm	8MA
1K	10	±0.1ohm	25MA
0.1K	1	±0.1ohm	79MA

Stability: +0.004% ohm per year or +0.04 ohm*

Relay Power: +5V, 490ma

IC Power: +5V, 510ma

Temperature Coefficient: 5ppm/^{o}C

Environmental Conditions:
Temperature: 10^{o}C to 45^{o}C

Relative Humidity: 0 to 70%

Logic: 4 line (1,2,4,8) BCD I/O, High True per decade

Dimension: 19" rack mount, 3 1/2" high, 7" deep. (Add 1 1/8" for front panel terminal posts).

Weight unpacked: approx. 13 lb., 8oz./6.14 kg.

The RD-105M resistance equals the value programmed by either the front panel switches or the rear connector logic inputs plus 1 ohm

* Whichever is greater

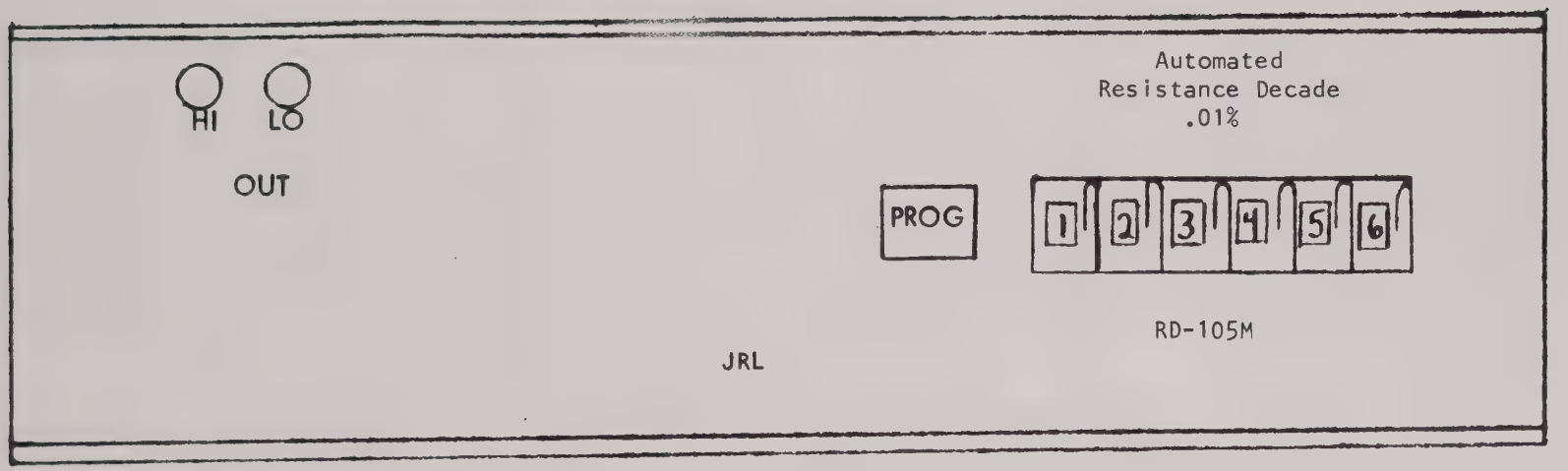


FIGURE 1.1 MODEL RD-105M
RELAY OPERATED DECADE RESISTANCE

SECTION 2

INSTALLATION

2-1 INSTALLATION AND PREPARATION FOR USE

This section contains information and instruction necessary for shipment and installation of the RD-105M, as well as initial inspection procedures.

2-2 UNPACKING AND INITIAL INSPECTION

Upon receiving, remove the instrument from its packing crate and check for any damage incurred in shipping.

After visual inspection of the RD-105M, perform the installation and checkout procedures as outlined below.

2-3 INSTALLATION

The RD-105M is designed for mounting in a standard 19" rack. Four mounting screws (not supplied) should be used to secure the instrument, P/N 012010.

Connect a 5V, 1 amp power supply to rear connector as follows:

The positive lead must be connected to pin 27 of rear connector, the negative lead to pin 26 of the rear connector. It is advisable to fuse the positive lead for the 1.5 amp (Fast Blo).

Operation of the decade dials of the RD-105M selects the dialed resistance plus one ohm.

2-4 INITIAL CHECKOUT

Measure the resistance between the input HI and input LO terminals. The resistance should be as indicated in Table 2-1.

Starting with all decade dials set to 0, rotate each decade dial in turn and note the meter reading in each switch position. The meter readings should correspond to those in Table 3-1.

TABLE 2-1 INITIAL CHECKOUT (See Figure 1.1)

DECADE	RESISTANCE READING
ALL ZERO	1 ohm
1	10K ohm/step
2	1K ohm/step
3	100 ohms/step
4	10 ohms/step
5	1 ohm/step

2-5 PREPARATION FOR AUTOMATIC OPERATION

Table 2.2 shows the functions of each pin on the rear connectors A and B. Selection of any digit in any decade is accomplished by applying the proper code to the proper connector pin for that digit. The voltage may be applied by means of either solid state or electro mechanical devices which are controlled manually for remote-manual operation or automatically (by computer, etc.) for fully automated operation. In all cases the negative lead is connected to the decade relay common Pin 26 on connector A or B.

Check the RD-105M for automatic operation either by varying decade digits automatically or by manually applying voltage to the proper pins on the rear connector to acheive the desired resistance setting. The checkout procedure is the same as outlined above in 2-4.

2-6 PROGRAM MODE CHEKOUT PROCEDURE

1. Depress the PROG button (in position).

2. Apply the proper codes to select the desired resistance to connector 'A'.

Resistance	Pins Numbers*
10K/steps	see Table 2-2
1K/steps	"
100ohm/steps	"
10ohm/steps	"
1ohm/steps	"

See Table 2-2 for program codes condition

3. Connect ohm meter to HI and LO terminal on RD-105M to monitor the resistance.

*Unused decade/s must be programmed for ZERO, otherwise the RD-105M will not function properly in the PROG mode.

TABLE 2-2

STANDARD I/O PIN IDENTIFICATION (BCD) & PROGRAM CODE CONDITIONS

PIN CONNECTIONS:
(A) STANDARD: BCD I/O REAR CONNECTORS

"A" CONNECTOR

PIN	FUNCTION Decade/Weight		SOURCE
1	MSD	1/1 Output	RD
2	"	1/2 "	"
3	"	1/4 "	"
4	"	1/8 "	"
5		2/1 "	"
6		2/2 "	"
7		2/4 "	"
8		2/8 "	"
9		3/1 "	"
10		3/2 "	"
11		3/4 "	"
12		3/8 "	"
13		4/1 "	"
14		4/2 "	"
15		4/4 "	"
16		4/8 "	"
17		5/1 "	"
18		5/2 "	"
19		5/4 "	"
20		5/8 "	"
21		Not used	
22		Not used	
23		Not used	
24		Not used	
25		N/C	
26		GND	USER
27		IC POWER	USER
28-36		N/C	

"B" CONNECTOR

PIN	FUNCTION Decade/Weight		SOURCE
1	MSD	1/1 Input	USER
2	"	1/2 "	"
3	"	1/4 "	"
4	"	1/8 "	"
5		2/1 "	"
6		2/2 "	"
7		2/4 "	"
8		2/8 "	"
9		3/1 "	"
10		3/2 "	"
11		3/4 "	"
12		3/8 "	"
13		4/1 "	"
14		4/2 "	"
15		4/4 "	"
16		4/8 "	"
17		5/1 "	"
18		5/2 "	"
19		5/4 "	"
20		5/8 "	"
21		Not used	
22		Not used	
23		Not used	
24		Not used	
25		Prog. Mode Low True	
26		GND (5 com)	USER
27		IC POWER (5 volts)"	
28-36		N/C	

Looking from the rear of the RD-105M, the "B" connector is located on the left and the "A" connector to the right.

*For serial numbers 115 and higher, pin 25 on connectors 'A' and 'B' are internally connected.

PROGRAM CODE CONDITIONS:

STANDARD: Binary Coded Decimal (BCD) I/O
High True, Standard TTL Levels
False = Low>0V,<.4V
True = High>2.8V,<5V
Input loading, 1 normalized TTL Load, Output, 8 normalized TTL Loads

2-7 PROGRAM MODE

The front panel of the RD-105M contains a program button. The program button when not depressed places the unit into the manual mode. In the manual mode the lever wheel switches control the resistance setting. When the program button is depressed, the PROG button light will come on. The RD-105M output resistance is now controlled by BCD coded levels. All user programming lines can be left activated during the manual mode with no extra loading or damage occuring. The manual and programmable information are isolated by the use of internal digital multiplexers.

2-8 EXTERNAL WIRING CONNECTIONS

The RD-105M is provided with heavy copper terminals. To minimize thermal EMF's at the terminals, connecting leads of similar material should be used.

Lead diameter and length must be consistent with good measurement practice. Leads not smaller than AWG #18 are recommended.

To minimize leakage effects teflon insulated or air supported leads should be used. Lead length should be as short as possible.

2-9 GROUNDING AND EXTERNAL EQUIPMENT REQUIREMENTS

When the RD-105M is used in conjunction with a galvanometer, it is desirable to have one input lead of the galvanometer grounded. Batteries or other voltage sources must be isolated from the galvanometer by 10,000 Megohms (minimum) leakage resistance.

The galvanometer used must be able to withstand such voltages as may be introduced between the circuit and the case. Isolation between input and case should be at least 100,000 Megohms. The use of a battery operated, guarded input, galvanometer such as Model ND-106 mounted on a styrofoam pad will provide ideal isolation in most applications.

2-10 PACKAGING FOR RESHIPMENT

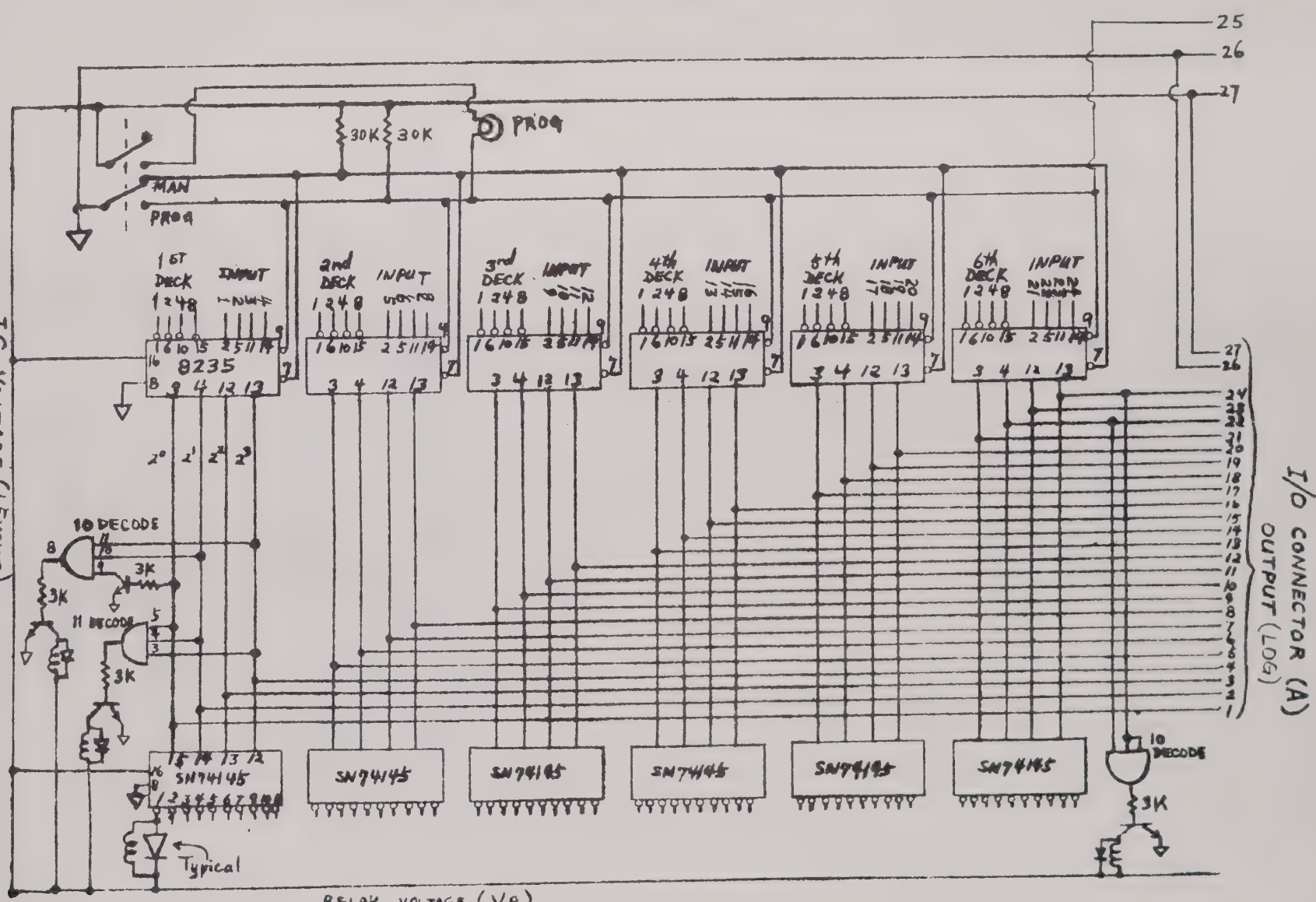
Prior to repackaging, call the factory for a return authorization number. Shipment without this RA number may be unaccepted by JRL receiving.

Wrap RD-105M in heavy paper or plastic and place in inner carton. Place a 4" thick layer of packing material between instrument and walls of inner carton and seal. Place inner carton in heavy cardboard or wood box allowing at least three inches of packing material on ALL sides between the two containers, and seal with heavy tape or steel bands.

TABLE 3-1

Accuracy Data Sheet

RD SETTING	READING (KOHMS)	±LIMITS
000 000	___.____	0.0011 0.0009
100 000	___.____	10.0020 10.0000
200 000	___.____	20.0030 19.9990
300 000	___.____	30.0040 29.9980
400 000	___.____	40.0050 39.9970
500 000	___.____	50.0060 49.9960
600 000	___.____	60.0070 59.9950
700 000	___.____	70.0080 69.9940
800 000	___.____	80.0090 79.9930
900 000	___.____	90.0100 89.9920
111 110	___.____	11.1130 .1110
222 220	___.____	22.2250 .2210
333 330	___.____	33.3370 .3310
444 440	___.____	44.4490 .4410
555 550	___.____	55.5610 .5510
666 660	___.____	66.6730 .6610
777 770	___.____	77.7850 .7710
888 880	___.____	88.8970 .8810
999 990	___.____	100 0090 99.9910



No Resistance from 6th Decade on RD-105M

Figure 2-1 for RD-105M Designation

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SECTION 4

OPERATION PROCEDURE

4-1 MANUAL OPERATION

4-2 With RD-105M connector wired per para. 2-3, connect input HIGH and LO terminals to the external circuit with suitably insulated, low resistance leads.

4-3 Dial or program the desired resistance less one ohm.

4-4 For rated accuracy, operating voltage should not exceed 100V. See Table 1-1

4-5 AUTOMATIC OPERATION

Procedures of 4-1 through 4-4 apply to automated operation except that the decade settings are controlled either automatically or remotely as described in Section 2.

SECTION 5

PARTS LIST

RECOMMENDED SPARES

Ref. Id.	JRL P/N	Qty	Description	Mfg	Mfg P/N
IC-10	547168	2	BCD to 10 Line Decoder		SN74145
IC-6	547166	2	Multiplexer		N8235

MECHANICAL PARTS

Ref.Ident	JRL Part No.	Tot.Qty.	Description	MFG	MFG P/N
J1,2,3,4	ITB59	2	TERMINALS	H.H.Smith	21859-103
	ITB75	2	CHASSIS TEFLON JACK	Cambion	450-4352-1-0319
	000187	2	CHASSIS CONNECTOR	AMP	57-20360
S1-5	RVD-031	5	SWITCH	DB1-6	RVD-034
RSM 1	RD-046-1	1	RESISTOR SWITCHING MOD.1 includes R1-R9	JRL	-
RSM 2	RD-046-2	1	RESISTOR SWITCHING MOD. 1 including R11-R18	JRL	-
RSM 3	RVD-046-3	1	RESISTOR SWITCHING MOD. 1 including R19-R27	JRL	-
RSM 4	RVD-046-4	1	RESISTOR SWITCHING MOD. 4 includes R28-R36	JRL	-
RSM 5	RD-046-5	1	RESISTOR SWITCHING MOD. 5 includes R37-R45	JRL	-
DC 1	RVD-3839	1	DUST COVER	JRL	-

ELECTRICAL PARTS

Ref.Ident	JRL P/N	Tot.Qty	Description	MFG	MFG P/N
D1	543038	50	DIODE 1N914		1N914
R1-9	RD-027-1	9	FIXED PRECISION MATCHED RESISTOR SET	JRL	-
R10-18	RD-027-2	9	FIXED PRECISION MATCHED RESISTOR SET	JRL	-
R19-27	RD-027-3	9	FIXED PRECISION MATCHED RESISTOR SET	JRL	-
R28-36	RD-027-4	9	FIXED PRECISION MATCHED RESISTOR SET	JRL	-

R37-45	RD-027-5	9	FIXED PRECISION MATCHED RESISTOR SET JRL	-
IC-10	547168	6	BCD TO 10 DECIMAL DECODER	SN74145
IC-6	547166	6	MULTIPLEXER	N8235
	ILA4	1	LAMP,MINIATURE,CHICAGO	CM377
P-SW	ISR-160D	1	ILLUMINATED PUSHBUTTON SWITCH	

WARRANTY

JULIE RESEARCH LABORATORIES, INC. guarantees to the original purchaser that all instruments shall be free from defects in material and workmanship for a period of one (1) year after date of initial shipment. Our liability is limited to repairing and replacing any defective part with the exception of vacuum tubes, panel lamps, fuses, choppers, and batteries. The warranty lapses, if upon our investigation, we judge that the instrument has been in any way.

WARRANTY RESRICTIONS

If the instrument or any portion therof has been abused, misused, damaged by accident or negligence, or if any serial number or seal has been removed or altered, the warranty is void.

All claims for instruments found to be defective on receipt must be filed in writing 30 days from date of invoice.

SHIPPING INSTRUCTIONS

If equipment is in warranty, equipment must be returned to JRL transportation pre-paid in order to maintain the validity of the warranty. All shipping and related charges for any equipment returns, in warranty or otherwise, shall be paid by the customer.

Each individual init, whether alone or part of a system, is to be packed separately, using an inner and outer carton there must be at minimum three inches of packing on all sides in the inner carton with four inches top and bottom. The outer carton must cantain minimum three inches sides, top and bottom.

NO RETURNS SHALL BE ACCEPTED NY JRL WITHOUT A RETURN AUTHORIZATION NUMBER

Please call customer service (212) 245-2727 for a return authorization number JRL is not abligated to accept any equipment, regardless of warranty status, unless such equipment has been assigned a return authorization number.

AC INSTRUMENTS TO BE SHIPPED UPSIDE DOWN.

AC-50T
CS-112
CS-129/LZ

RCD-10
RCD-709
RCD-1160
RCD-1160C
RCD-1160V

WARRANTY ON REPAIR

Julie Research Laboratories, Inc. guarantees to the equipment owner that repairs on instrument returns will be free from defect in material and workmanship for a period of 90 days after the instrument has been shipped. This warranty is limited to repairs performed and replaced parts. Our liability is limited to repairing and replacing any defective part with the exception of vacuum tubes, panel meter, fuses, choppers, and batteries. The warranty lapses, if on our investigation, we judge that the instrument has been abused in any way.

WARRANTY RESRICTIONS

If the instrument or any portion thereof has been abused, misused, damaged by accident or negligence, or if any serial number or seal has been removed or altered, the warranty is void.

All claims for instruments found to be defective on receipt must be filed in writing 30 days from date of invoice.

SHIPPING INSTRUCTIONS

If equipment is in warranty, equipment must be returned to JRL transportation prepaid in order to maintain the validity of the warranty. All shipping and related charges for any equipment returns, in warranty or otherwise, shall be paid by the customer.

Each individual unit, whether alone or part of a system, is to be packed separately with sufficient padding to insure safe transportation. The equipment should be repacked using an inner and outer carton, there must be at minimum three inches of packing on all sides in the inner carton with four inches top and bottom. The outer carton must contain minimum three inches sides, top and bottom. Failure to comply will render the warranty null and void and the shipment will not be accepted.

NO RETURNS SHALL BE ACCEPTED BY JRL WITHOUT A RETURN AUTHORIZATION NUMBER

Please call customer service (212) 245-2727 for a return authorization number. JRL is not obligated to accept any equipment, regardless of warranty status, unless such equipment has been assigned a return authorization number.

AC INSTRUMENTS TO BE SHIPPED UPSIDE DOWN.

AC-50T
CS-112

QCS-110
RCD-10
RCD-1160
RCD-709
RCD-1160V
RCD-1160C

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